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PATENT APPLICATION
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

UTILITY PATENT
APPLICATION TRANSMITTAL LETTER



Asst. Commissioner for Patents
Box Patent Application
Washington, D.C. 20231

Sir:

Enclosed for filing is an ☒ original patent application or, ☐ a continuation-in-part patent application, by inventor(s) Daniel ManHung Wong, entitled REFORMING QUERIES TO SELECTIVELY AUDIT ACCESSES TO ROWS WITHIN A RELATIONAL DATABASE.

No. of pages in Specification: 19; No. of Claims: 24.

No. of Sheets of Drawings: Formal: 3, Informal: 0.

Also enclosed are:

- ☐ a claim for foreign priority under 35 U.S.C. §§ 119 and/or 365 in
- ☐ a separate document ☐ the declaration;
- ☐ a certified copy of the priority document;
- ☐ an Associate Power of Attorney;
- ☐ ___ verified statement(s) claiming small entity status;
- ☒ a Combined Declaration and Power of Attorney of the inventors(s);
- ☐ a signed Combined Declaration and Power of Attorney of the inventors will follow;
- ☒ an Assignment document and form PTO-1595;
- ☒ a Power of Attorney by Assignee; and
- ☐ Information Disclosure Statement and Form PTO-1449.

The fee has been calculated as follows:

CLAIMS					
	NO. OF CLAIMS		EXTRA CLAIMS	RATE	FEE
Basic Application Fee					\$690.00
Total Claims	24	MINUS 20 =	4	\$18.00=	\$72.00
Independent Claims	3	MINUS 3 =	0	\$78.00=	\$0.00
If multiple dependent claims are presented, add \$260.00					0
Total Application Fee					\$762.00
If verified statement claiming small entity status is enclosed, subtract 50% of Total Application Fee					
Add Recording Fee of \$40.00 if Assignment document is enclosed					\$40.00
TOTAL APPLICATION FEE DUE					\$802.00

- ☒ A check in the amount of \$ 802.00 is enclosed.
- ☐ Application fee will follow with missing parts.
- ☒ Please deduct any underpayments or credit any overpayments to Deposit Account Number 50-1003.

Please direct all correspondence concerning the above-identified application to the following address:

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22835

PATENT TRADEMARK OFFICE

Respectfully submitted,

By

A. Richard Park
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Date: April 26, 2000

"Express Mail" Mailing Label No. EL436467498US

PATENT APPLICATION
ATTORNEY DOCKET NO. OR00-01101

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REFORMING QUERIES TO SELECTIVELY
AUDIT ACCESSSES TO ROWS WITHIN A
RELATIONAL DATABASE

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Inventor(s): Daniel ManHung Wong

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Related Application

The subject matter of this application is related to the subject matter in a
co-pending non-provisional application by inventors Daniel ManHung Wong,
Chon Hei Lei and Patrick F. Sack, filed on the same day as the instant application
entitled, "Selectively Auditing Accesses to Rows Within a Relational Database at
a Database Server," having serial number TO BE ASSIGNED, and filing date TO
BE ASSIGNED (Attorney Docket No. OR00-00801).

25

BACKGROUND

Field of the Invention

The present invention relates to providing security in computerized
databases. More specifically, the present invention relates to a method and an

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apparatus for selectively auditing accesses to relational database tables based upon auditing conditions.

Related Art

5 Databases commonly store highly sensitive data, such as salaries, corporate financial data, and even classified military secrets. For security reasons it is essential to be able to audit accesses to this sensitive data. Conventional database systems typically provide a general auditing facility that records an audit trail containing general information about the user and the query issued.

10 However, conventional auditing facilities have a number of shortcomings. They do not record specific information about the application, the session environment or most importantly, the query results. Consequently, information gathered by a conventional auditing facility is frequently insufficient to reconstruct an event, or even to determine whether access rights have been
15 violated.

 In conventional relational database systems, auditing facilities only record information regarding which tables are accessed, not whether certain rows inside a given table are accessed. This table-level auditing tends to generate a large number of false audit records because many accesses to a given table do not touch
20 sensitive data.

 What is needed is an auditing mechanism that can specify a finer granularity of audit conditions during accesses to relational tables in order to minimize the number of false audit records that are generated.

 Another problem in auditing database accesses arises in distributed
25 database architectures, in which an application located on an application server sends a query to a database located on a database server. In this type of distributed architecture, auditing is typically performed by embedding customized

auditing mechanisms into the application on the applications server, not at the database server. Relying on the application to perform auditing can give rise to many problems because a large number of applications can potentially access the database. Consequently, it is almost impossible to ensure that each one of these applications is configured to perform the auditing properly.

What is needed is an auditing mechanism for database accesses which does not rely on applications outside of the database server to perform auditing.

SUMMARY

One embodiment of the present invention provides a system that selectively audits accesses to a relational database. The system receives a query at the relational database and modifies the query so that processing the query causes an audit record to be created and recorded for rows in relational tables that are accessed by the query and that satisfy an auditing condition. Next, the system processes the modified query to produce a query result. This processing causes an audit record to be created for rows in relational tables that are accessed by the query and that satisfy the auditing condition. The system records the audit record in an audit record store, and then returns the query result.

In one embodiment of the present invention, if the query includes a select statement, the system inserts a case statement into the select statement. This case statement calls a function that causes the audit record to be created and recorded if the auditing condition is satisfied. In a variation on this embodiment, the case statement is evaluated near the end of the query processing so that the case statement is evaluated only after other conditions of the query are satisfied. In this way, an audit record is created only for rows that are actually accessed by the query.

In one embodiment of the present invention, the system retrieves the auditing condition for a table from a data structure associated with the table.

In one embodiment of the present invention, if the query modifies at least one entry in the relational database, the system uses a relational database system trigger to create and record the audit record for the modification to the relational database.

In one embodiment of the present invention, inserting the case statement into the query further involves a number of actions. The system first inserts the case statement into the query. Next, the system allows a query processor to allocate buffers for the query. The system then removes the case statement from the query and allows the query processor to generate a query plan for the query. The system schedules the case statement near the end of the query plan to ensure that the case statement is evaluated only after other conditions of the query are satisfied. In this way, the audit record is created only for rows that are actually accessed by the query.

In one embodiment of the present invention, the audit record includes, a user name for a user making the query, a time stamp specifying a time of the query and a text of the query.

In one embodiment of the present invention, the auditing condition includes a condition for a field within the relational database.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 illustrates a distributed computing system in accordance with an embodiment of the present invention.

FIG. 2 illustrates a table within a relational database in accordance with an embodiment of the present invention.

FIG. 3 is a flow chart illustrating the process of auditing a query in accordance with an embodiment of the present invention.

FIG. 4 is a flow chart illustrating the process of reforming a query for auditing purposes in accordance with an embodiment of the present invention.

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DETAILED DESCRIPTION

The following description is presented to enable any person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the disclosed
10 embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features
15 disclosed herein.

The data structures and code described in this detailed description are typically stored on a computer readable storage medium, which may be any device or medium that can store code and/or data for use by a computer system. This includes, but is not limited to, magnetic and optical storage devices such as disk
20 drives, magnetic tape, CDs (compact discs) and DVDs (digital video discs), and computer instruction signals embodied in a transmission medium (with or without a carrier wave upon which the signals are modulated). For example, the transmission medium may include a communications network, such as the Internet.

25

Distributed Computing System

FIG. 1 illustrates a distributed computing system 100 in accordance with an embodiment of the present invention. Distributed computing system 100 includes a number of computer systems (nodes), including clients 102-104, application server 108 and database server 110. Computer systems 102-104, 108 and 110 can generally include any type of computer system, including, but not limited to, a computer system based on a microprocessor, a mainframe computer, a digital signal processor, a personal organizer, a device controller, and a computational engine within an appliance.

Computer systems 102-104, 108 and 110 are coupled together by a computer network (not shown). This computer network can include any type of wire or wireless communication channel capable of coupling together computing nodes. This includes, but is not limited to, a local area network, a wide area network, or a combination of networks. In one embodiment of the present invention, this network includes the Internet.

Clients 102-104 can include any node on a network including computational capability and including a mechanism for communicating across the network. In the embodiment of the present invention illustrated in FIG. 1, clients 102-104 communicate with application 107 located on application server 108. Application 107 in turn communicates with relational database 109 on database server 110. Application server 108 and database server 110 can include any node on a computer network including a mechanism for servicing requests from a client for computational and/or data storage resources. Note that application server 108 serves as a client for database server 110.

Database server 110 contains relational database 109. Relational database 109 can generally include any type of database system designed around relation tables. Within relational database 109 there exist a number of mechanisms,

including query processor 120 and auditing mechanism 122. Query processor 120 operates on a number of relational tables 113, including table 114 and table 116. Auditing mechanism 122 records audit records to audit record store 118.

Note that tables 113 and audit record store 113 reside on storage device 112, which is controlled by database server 110. Storage device 112 can include any type of non-volatile storage device, such as non-volatile storage devices based on magnetic, optical and/or magneto-optical storage devices. Storage device 112 can also include non-volatile semiconductor storage devices based on flash memory or battery-backed up random access memory. Note that copies of selected portions of tables 113 and audit record store 118 can also exist within memory in database server 110.

Table Structure

FIG. 2 illustrates the structure of table 114 within relational database 119 in accordance with an embodiment of the present invention. Table 114 has the same structure as a typical table in a relational database, including a number of rows containing various fields.

Table 114 also includes a row-level auditing flag 206 which indicates whether auditing is enabled for the table. In another embodiment of the present invention, the system includes a database-wide row-level auditing flag, which enables row-level auditing for the entire relational database 109.

Table 114 is additionally associated with a number of auditing conditions, including auditing condition 202 “salary > 1,000,000” and auditing condition 204 “title = ‘CEO’”. Auditing conditions 202 and 204 instruct relational database 109 to create an audit record for any rows that are accessed within table 114 that include a salary field with a value greater than 1,000,000, or that include a title

field specifying a CEO. Accesses to other rows in table 114 that do not satisfy either of these auditing conditions do not cause an audit record to be generated.

Process of Auditing a Query

5 FIG. 3 is a flow chart illustrating the process of auditing a query in accordance with an embodiment of the present invention. The system starts by receiving a query 123 at relational database 109 within database server 110 from application 107 within application server 108 (step 302).

10 The system first determines if auditing is enabled by checking all tables referenced by the query to see if an auditing flag is set for the tables (step 303). If auditing is not enabled, the system processes query 123 as usual to produce a query result 124 (step 305), and then returns query result 124 (step 314).

15 If auditing is enabled, the system modifies the query by inserting monitoring logic into query 123 (step 304). This monitoring logic causes an audit record to be created and recorded for any rows that satisfy an auditing condition.

 In one embodiment of the present invention, query 123 is modified by inserting statements into query 123 to make query 123 call a function that creates and records auditing records if a row in a table satisfies the auditing conditions.

20 In another embodiment of the present invention, modifying query 123 involves creating two separate queries. A first query additionally includes restrictions based on the auditing conditions. This query produces audit records only for rows that satisfy the auditing conditions. A second query is unmodified from the initial query and is used to produce the query result.

25 In one embodiment of the present invention, the auditing condition is specified for the entire relational database 109. In another embodiment, the auditing condition is specified on a table-by-table basis.

Next, the optimization layer performs view merging (step 305), and the system processes query 123 to produce the query result 124 (step 306). In doing so, the system creates an audit record for rows that are accessed by query 123 and that satisfy the auditing condition (step 310). Alternatively, the audit record can
5 be produced by running a second query at a later time to produce the audit record.

Note that the audit record includes a user name for a user making the query, a time stamp specifying a time of the query, a text of the query and specific variable bindings for the query.

The system then records the audit record in audit record store 118 (step
10 312) and then returns the query result 124 to application 107 (step 314).

Process of Reforming a Query

FIG. 4 is a flow chart illustrating the process of reforming a query for auditing purposes in accordance with an embodiment of the present invention.
15 The system starts by receiving a query 123 at relational database 109 (step 402). The system next retrieves any auditing conditions that might exist for tables involved in query 123, such as auditing conditions 202 and 204 associated with table 114 (step 404).

If query 123 includes a statement that modifies a table within relational
20 database 109, such as a delete statement, an insert statement or an update statement, the system uses pre-existing triggers in the database system to create audit records for these statements (step 405). Note that a database system generally maintains a log of changes to database tables, so providing an auditing mechanism for these changes in addition to the log may be unnecessary. The
25 system then processes query 123 to produce query result 124 (step 418).

If query 123 includes a select statement, the system appends a case statement to query 123 for each auditing condition using a view expansion

mechanism (step 406). For example, suppose that the auditing condition is DEPT = 'SALES' and that query 123 is,

```
SELECT * FROM payroll WHERE salary>150,000;
```

5

The system appends a case statement to the select statement as follows.

```
SELECT * FROM
```

```
(
```

10

```
    SELECT * FROM payroll
```

```
    WHERE (CASE WHEN (dept= 'sales') THEN SYS_AUDIT()
```

```
    ELSE NOT NULL END) IS NOT NULL;
```

```
)
```

```
WHERE salary > 150,000
```

15

In this example, the case statement will cause the SYS_AUDIT() function to be called if the auditing condition is satisfied. This SYS_AUDIT() function causes an audit record to be created and recorded.

Note that the function SYS_AUDIT() always returns NOT NULL (unless an error condition arises within SYS_AUDIT()). Therefore the predicate is always evaluated as TRUE. Hence, the predicate does not affect the logic of query 123, and the predicate can be safely applied to query 123.

Next, the query processor is allowed to allocate buffers for query 123 (step 408). After the buffers are allocated, the system removes the case statement from query 123 (step 410). In one embodiment of the present invention, this involves moving a query filter list data structure that refers to the predicate to a temporary location in the query block data structure that contains all the meta-information

for query 123. Moving the predicate in this way prevents the optimizer from reorganizing the CASE clause and query plan layer to allocate row source for the CASE clause.

5 After optimization, the system generates a query plan for query 123 to specify an order in which the operations involved in query 123 are carried out (step 412).

10 After the query plan is generated (but before generating the execution plan for any "GROUP BY" clause that may exist) the system generates an execution plan for the case statement so that the case statement is evaluated only for rows that satisfy all the preceding conditions in query 123 (step 414). In this way, an audit record is created only for rows are accessed by query 123.

Next, the system processes query 123 to produce query result 124 (step 418). This causes an audit record to be created (step 420) and recorded (step 422) for each row that satisfies the conditions of query 123 as well as the auditing conditions.

15 Finally, the system returns query result 124 to the entity that issued query 123 (step 424).

The foregoing descriptions of embodiments of the invention have been presented for purposes of illustration and description only. They are not intended to be exhaustive or to limit the present invention to the forms disclosed.

20 Accordingly, many modifications and variations will be apparent to practitioners skilled in the art. Additionally, the above disclosure is not intended to limit the present invention. The scope of the present invention is defined by the appended claims.

What Is Claimed Is:

1 1. A method for selectively auditing accesses to a relational database,
2 comprising:
3 receiving a query for the relational database;
4 modifying the query so that processing the query causes an audit record to
5 be created and recorded for rows in relational tables that are accessed by the query
6 and that satisfy an auditing condition;
7 processing the modified query to produce a query result, wherein
8 processing the modified query includes,
9 creating the audit record for rows in relational tables that
10 are accessed by the query and that satisfy the auditing condition,
11 and
12 recording the audit record in an audit record store; and
13 returning the query result.

1 2. The method of claim 1, further comprising, if the query includes a
2 select statement, inserting a case statement into the select statement that calls a
3 function that causes the audit record to be created and recorded if the auditing
4 condition is satisfied.

1 3. The method of claim 2, further comprising ensuring that the case
2 statement is evaluated near the end of the query processing so that the case
3 statement is evaluated only after other conditions of the query are satisfied, so that
4 the audit record is created only for rows that are actually accessed by the query.

1 4. The method of claim 1, further comprising retrieving the auditing
2 condition for a given table from a data structure associated with the given table.

1 5. The method of claim 1, wherein if the query modifies at least one
2 entry in the relational database, using a relational database system trigger to create
3 and record the audit record for the modification to the relational database.

1 6. The method of claim 2, wherein inserting the case statement into
2 the query further comprises:
3 inserting the case statement into the query;
4 allowing a query processor to allocate buffers for the query;
5 removing the case statement from the query;
6 allowing the query processor to generate a query plan for the query; and
7 scheduling the case statement near the end of the query plan to ensure that
8 the case statement is evaluated only after other conditions of the query are
9 satisfied, so that the audit record is created only for rows that are actually accessed
10 by the query.

1 7. The method of claim 1, wherein the audit record includes:
2 a user name for a user making the query;
3 a time stamp specifying a time of the query; and
4 a text of the query.

1 8. The method of claim 1, wherein the auditing condition includes a
2 condition for a field within the relational database.

1 9. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method for
3 selectively auditing accesses to a relational database, the method comprising:
4 receiving a query for the relational database;
5 modifying the query so that processing the query causes an audit record to
6 be created and recorded for rows in relational tables that are accessed by the query
7 and that satisfy an auditing condition;
8 processing the modified query to produce a query result, wherein
9 processing the modified query includes,
10 creating the audit record for rows in relational tables that
11 are accessed by the query and that satisfy the auditing condition,
12 and
13 recording the audit record in an audit record store; and
14 returning the query result.

1 10. The computer-readable storage medium of claim 9, wherein the
2 method further comprises, if the query includes a select statement, inserting a case
3 statement into the select statement that calls a function that causes the audit record
4 to be created and recorded if the auditing condition is satisfied.

1 11. The computer-readable storage medium of claim 10, wherein the
2 method further comprises ensuring that the case statement is evaluated near the
3 end of the query processing to that the case statement is evaluated only after other
4 conditions of the query are satisfied, so that the audit record is created only for
5 rows that are actually accessed by the query.

1 12. The computer-readable storage medium of claim 9, wherein the
2 method further comprises retrieving the auditing condition for a given table from
3 a data structure associated with the given table.

1 13. The computer-readable storage medium of claim 9, wherein if the
2 query modifies at least one entry in the relational database, the method further
3 comprises using a relational database system trigger to create and record the audit
4 record for the modification to the relational database.

1 14. The computer-readable storage medium of claim 10, wherein
2 inserting the case statement into the query further comprises:
3 inserting the case statement into the query;
4 allowing a query processor to allocate buffers for the query;
5 removing the case statement from the query;
6 allowing the query processor to generate a query plan for the query; and
7 scheduling the case statement near the end of the query plan to ensure that
8 the case statement is evaluated only after other conditions of the query are
9 satisfied, so that the audit record is created only for rows that are actually accessed
10 by the query.

1 15. The computer-readable storage medium of claim 9, wherein the
2 audit record includes:
3 a user name for a user making the query;
4 a time stamp specifying a time of the query; and
5 a text of the query.

1 16. The computer-readable storage medium of claim 9, wherein the
2 auditing condition includes a condition for a field within the relational database.

1 17. An apparatus that selectively audits accesses to a relational
2 database, comprising:
3 a receiving mechanism that is configured to receive a query for the
4 relational database;
5 a query modification mechanism that is configured to modify the query so
6 that processing the query causes an audit record to be created and recorded for
7 rows in relational tables that are accessed by the query and that satisfy an auditing
8 condition;
9 a query processor that is configured to process the modified query to
10 produce a query result, wherein processing the modified query includes,
11 creating the audit record for rows in relational tables that
12 are accessed by the query and that satisfy the auditing condition,
13 and
14 recording the audit record in an audit record store; and
15 a returning mechanism that is configured to return the query result.

1 18. The apparatus of claim 17, wherein if the query includes a select
2 statement, the query modification mechanism is configured to insert a case
3 statement into the select statement that calls a function that causes the audit record
4 to be created and recorded if the auditing condition is satisfied.

1 19. The apparatus of claim 18, wherein the query modification
2 mechanism is configured to ensure that the case statement is evaluated near the
3 end of the query processing so that the case statement is evaluated only after other

4 conditions of the query are satisfied, so that the audit record is created only for
5 rows that are actually accessed by the query.

1 20. The apparatus of claim 17, wherein the query modification
2 mechanism is configured to retrieve the auditing condition for a given table from a
3 data structure associated with the given table.

1 21. The apparatus of claim 17, wherein if the query modifies at least
2 one entry in the relational database, the apparatus uses a relational database
3 system trigger to create and record the audit record for the modification to the
4 relational database.

1 22. The apparatus of claim 18, wherein the query modification
2 mechanism is configured to:
3 insert the case statement into the query;
4 allow the query processor to allocate buffers for the query;
5 remove the case statement from the query;
6 allow the query processor to generate a query plan for the query; and
7 schedule the case statement near the end of the query plan to ensure that
8 the case statement is evaluated only after other conditions of the query are
9 satisfied, so that the audit record is created only for rows that are actually accessed
10 by the query.

1 23. The apparatus of claim 17, wherein the audit record includes:
2 a user name for a user making the query;
3 a time stamp specifying a time of the query; and
4 a text of the query.

- 1 24. The apparatus of claim 17, wherein the auditing condition includes
- 2 a condition for a field within the relational database.

REFORMING QUERIES TO SELECTIVELY AUDIT ACCESSES TO ROWS WITHIN A RELATIONAL DATABASE

ABSTRACT

One embodiment of the present invention provides a system that selectively audits accesses to a relational database. The system receives a query at the relational database and modifies the query so that processing the query causes an audit record to be created and recorded for rows in relational tables that are accessed by the query and that satisfy an auditing condition. Next, the system processes the modified query to produce a query result. This processing causes an audit record to be created for rows in relational tables that are accessed by the query and that satisfy the auditing condition. The system records the audit record in an audit record store, and then returns the query result. In one embodiment of the present invention, if the query includes a select statement, the system inserts a case statement into the select statement. This case statement calls a function that causes the audit record to be created and recorded if the auditing condition is satisfied. In a variation on this embodiment, the case statement is evaluated near the end of the query processing so that the case statement is evaluated only after other conditions of the query are satisfied. In this way, an audit record is created only for rows that are actually accessed by the query.

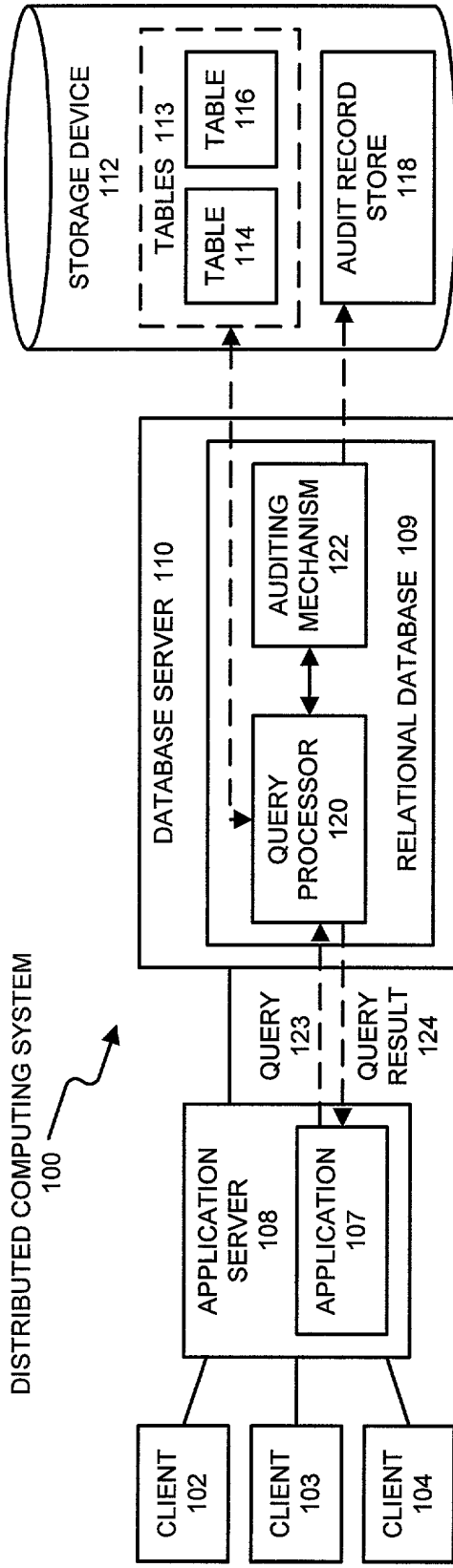


FIG. 1

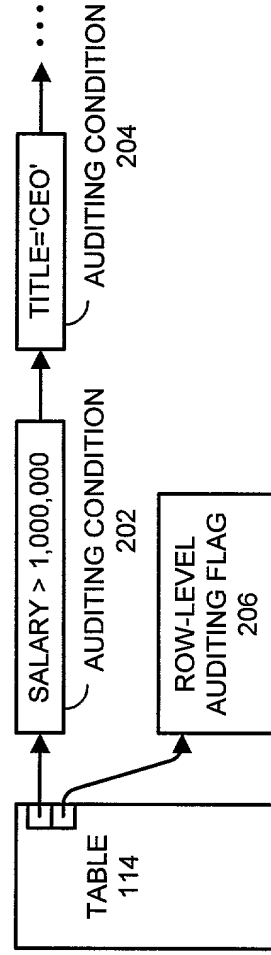


FIG. 2

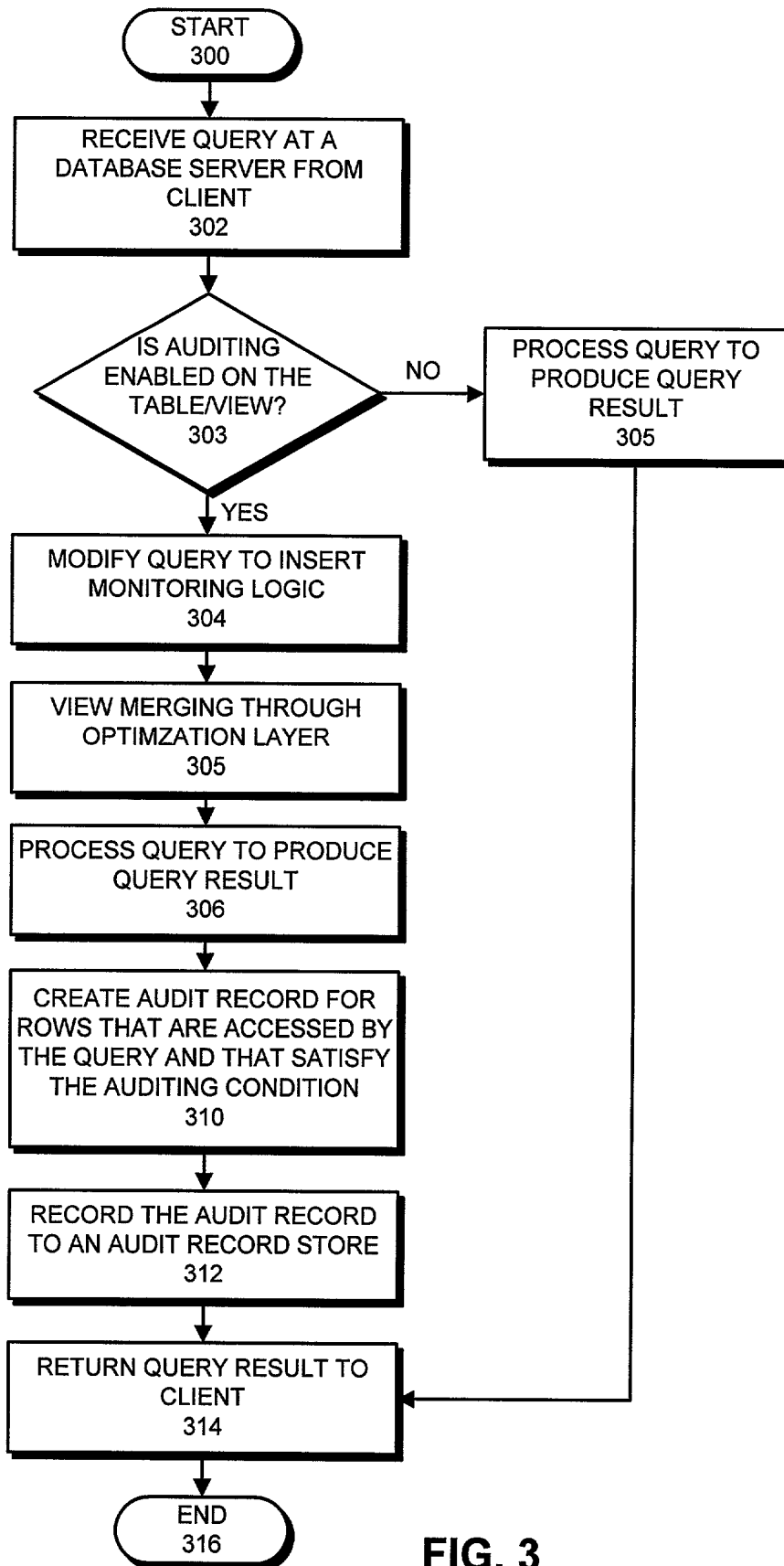


FIG. 3

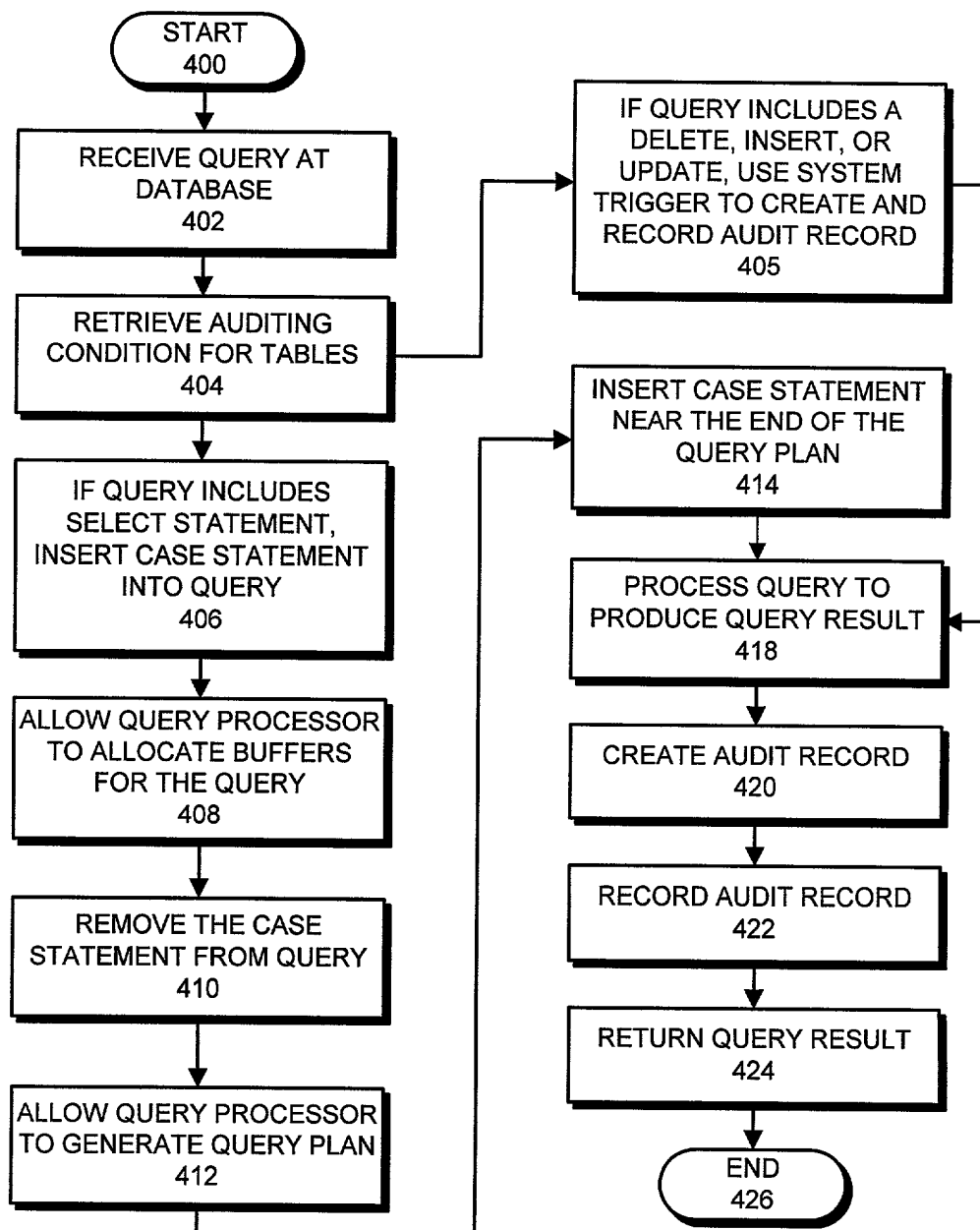


FIG. 4

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below by my name;

I believe I am the original, first and sole inventor, if only one name is listed below, or an original, first and joint inventor if multiple names are listed below, of the subject matter which is claimed and for which a patent is sought on the invention entitled:

REFORMING QUERIES TO SELECTIVELY AUDIT ACCESSES TO ROWS WITHIN A RELATIONAL DATABASE

for which a patent application:

☒ is attached hereto.

☐ was filed in the United States on _ as Application No. _;

☐ with amendment(s) filed on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the application identified above, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information known to me to be material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56, which states in relevant part:

Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section ... The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office..

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d), of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application on which priority is claimed:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED PRIOR TO THE FILING DATE OF THE APPLICATION			
APPLICATION NUMBER	COUNTRY	DATE OF FILING (Day, Month, Year)	PRIORITY CLAIMED
			YES <input type="checkbox"/> NO <input type="checkbox"/>

I hereby claim the benefit under Title 35, United States Code, §119(e), of any United States provisional application(s) listed below:

APPLICATION NUMBER	DATE OF FILING

I hereby claim the benefit under Title 35, United States Code, §120, of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information that is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	DATE OF FILING	STATUS		
		PATENTED	PENDING	ABANDONED

I hereby appoint Daniel E. Vaughan (Reg. No. 42,199) and A. Richard Park (Reg. No. 41,241) of PARK & VAUGHAN and

Sanjay Prasad (Reg. No. 36,247) of the Oracle Corporation to prosecute this application and transact all business in the Patent and Trademark Office connected therewith, and to file, prosecute and transact all business in connection with international applications directed to said invention.

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PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, §1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1	Name and Citizenship	Daniel ManHung Wong	United States of America
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	Postal Address (if different from Residence)	7425 SW	
	Signature and Date		Date 4/17/2000
2	Name and Citizenship		
	Residence Address		
	Postal Address (if different from Residence)		
	Signature and Date		Date
3	Name and Citizenship		
	Residence Address		
	Postal Address (if different from Residence)		
	Signature and Date		Date
4	Name and Citizenship		
	Residence Address		
	Postal Address (if different from Residence)		
	Signature and Date		Date
5	Name and Citizenship		
	Residence Address		
	Postal Address (if different from Residence)		
	Signature and Date		Date

Additional inventor name(s) and signature(s) attached?: YES ☐ NO ☒

**POWER OF ATTORNEY BY ASSIGNEE TO EXCLUSION OF INVENTOR UNDER
37 C.F.R. § 3.71 WITH REVOCATION OF PRIOR POWERS**

Inventor(s): Daniel ManHung Wong
Title: REFORMING QUERIES TO SELECTIVELY AUDIT ACCESSES TO
ROWS WITHIN A RELATIONAL DATABASE
Docket No: OR00-01101
Serial No. To Be Assigned
Filing Date: To Be Assigned
Group Art Unit: To Be Assigned
Examiner: To Be Assigned

The undersigned ASSIGNEE of the entire interest in the above-identified application for letters patent hereby appoints Sanjay Prasad, Registration No. 36,247, Roger P. Kennedy, Registration No. 44,823 and Christopher Brokaw, Registration No. P-45,620 of ORACLE CORPORATION, and A. Richard Park, Registration No. 41,241 and Daniel E. Vaughan, Registration No. 42,199 of PARK & VAUGHAN LLP, to prosecute this application and transact all business in the United States and Trademark Office in connection therewith and hereby revokes all prior powers of attorney; said appointment to be to the exclusion of the inventors and the inventors' attorneys in accordance with the provisions of 37 C.F.R. § 3.71.

The following evidentiary documents establish a chain of title from the original owner to the Assignee:

- ☒ a copy of an Assignment attached hereto, which Assignment has been (or is herewith) forwarded to the Patent and Trademark Office for recording; or
- ☐ the Assignment recorded on _____ at reel _____, frames _____ - _____.

Pursuant to 37 C.F.R. § 3.73(b) the undersigned Assignee hereby states that evidentiary documents have been reviewed and hereby certifies that, to the best of ASSIGNEE's knowledge and belief, title is in the identified ASSIGNEE.

Please direct all telephone calls and correspondence to: A. Richard Park, Park & Vaughan LLP, 508 Second Street Suite 201, Davis, CA 95616, tel: (530) 759-1661.

ASSIGNEE: Oracle Corporation

Signature: _____ 4/24/00
(Signature) (Date)

Name: _____ Sanjay Prasad

Title: _____ Chief Patent Counsel